A WINDSCREEN WIPER

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates to a windscreen wiper, which is also known as a windshield wiper.

Description of the Related Art

The invention relates in particular to a windscreen wiper which has a curved backbone and which may have a varying width and/or thickness. It will be appreciated by those skilled in the art that the backbone may be in the form of a beam that is curved in a plane or may have a compound curvature such as in EP-A-0 528 643 and DE-A-196 51 229. The beam will have width and thickness dimensions. The beam will also have a radius of curvature at each point along its length.

The applicant has conducted substantial analysis and experimentation and believes that he has found a relationship between the width, the beam material's Young's modulus and the total length of the beam and the thickness, the beam material's Young's modulus and the total length, which provides a windscreen wiper that operates in an improved manner.

In this specification, the term "spatially consolidated" is to be understood, unless the context clearly indicates otherwise, to mean that the actual perimeters of a cross-section coincides with the shortest possible perimeter encapsulating that cross-section.

According to a first aspect of the invention there is provided a windscreen wiper which includes

an elongate curved backbone which is of a resiliently flexible material having a Young's modulus of between 50 to 350 GPa, the backbone having a substantially spatially consolidated cross-sectional profile at substantially all points along its length, in which the magnitude of the width at substantially the widest point along the backbone, W_m (expressed in millimetres) is at most $(-8.889.10^{-5} * E + 0.05378) * L - 5.25$, where L is the total length of the backbone expressed in millimetres and E is the Young's modulus of the backbone material expressed in GPa.

Further according to this aspect, there is provided a windscreen wiper which includes

an elongate curved backbone which is of a resiliently flexible material having a Young's modulus of between 50 to 350 GPa, the backbone having a substantially spatially consolidated cross-sectional profile at substantially all points along its length, in which the ratio of the magnitude of the width at substantially the widest point along the backbone, to the total length L of the backbone, R_w is at most $(-8.889.10^{-5} * E + 0.05378) - 5.25/L$, where L is the total length of the backbone expressed in millimetres and E is the Young's modulus of the backbone material expressed in GPa.

According to a second aspect of the invention there is provided a windscreen wiper which includes

an elongate curved backbone which is of a resiliently flexible material having a Young's modulus of between 50 to 350 GPa, the backbone having a substantially spatially consolidated cross-sectional profile at substantially all points along its length,

in which the magnitude of the thickness at substantially the thickest point along the backbone, T_m (expressed in millimetres) is at most 0.0007 * L - 0.0027407 * E + 1.37814, where L is the total length of the backbone expressed in millimetres and E is the Young's modulus of the backbone material expressed in GPa.

Further according to this aspect, there is provided a windscreen wiper which includes

an elongate curved backbone which is of a resiliently flexible material having a Young's modulus of between 50 to 350 GPa, the backbone having a substantially spatially consolidated cross-sectional profile at substantially all points along its length, in which the ratio of the magnitude of the thickness at substantially the thickest point along the backbone to the total length L of the backbone, R_t is at most 0.0007 - (0.0027407 *E - 1.37814)/L, where L is the total length of the backbone expressed in millimetres and E is the Young's modulus of the backbone material expressed in GPa.

The material of the backbone may be a composite material. In this case, the Young's modulus will be that of the composite material.

The total length of the backbone may be between about 300mm to 1200mm.

The backbone may have a varying width and or thickness, along its length. The backbone may have a free form curvature in a plane or may have a compound curvature (that is, curved in two planes).

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is now described, by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a schematic perspective view from above of a windscreen wiper in accordance with the invention;

Figure 2 shows a side view of the wiper of Figure 1 in an unloaded free-form condition;

Figure 3 shows a graph indicating the variation of width of the backbone of the windscreen wiper shown in Figures 1 and 2;

Figure 4 shows a graph indicating the variation of thickness of the backbone of the windscreen wiper shown in Figures 1 and 2; and

Figure 5 shows a graph indicating the free-form co-ordinates of the centre line of the backbone of the windscreen wiper shown in Figures 1 and 2.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

In the drawings, a windscreen wiper in accordance with the invention is generally designated by the reference numeral 10. The windscreen wiper 10 includes a backbone 12 which is in the form of a beam and a rubber wiper blade 14. The beam is made from spring steel having a Young's modulus of 200 GPa. The length of the beam is 600mm. The beam has a rectangular cross-sectional profile at all points along its length. Thus, the beam has a width dimension W and a thickness dimension T as shown in Figure 1. The beam tapers both in width and thickness from its centre toward its free ends or tips as shown in Figure 3 and Figure 4 respectively. Figure 3 illustrates the beam width (in millimetres) at various positions along the length of the beam, which is also measured in millimetres. Figure 4 illustrates the thickness of the beam (in millimetres) at various positions along the length of the beam which is also measured in millimetres.

The beam is curved longitudinally, in a plane, with a predetermined radius of curvature R at every point along its length as shown in Figure 2. Figure 5 shows the beam centre line co-ordinates relative to the position along the length of the beam (in millimetres).

With the given formulas, it can be determined if the wiper, as described in the drawings conforms to the invention. The width of the beam 12 at its widest point along the beam 12, W_m (expressed in millimetres) is 15.4 as shown in Figure 3. According to the first aspect of the invention, the magnitude of the width at the widest point along the beam 12, W_m (expressed in millimetres), where L is 600 mm and E is 200 GPa, should be less than $(-8.889.10^{-5} * E + 0.05378) * L - 5.25 = (-8.889.10^{-5} * 200 + 0.05378) * 600 - 5.25 = 16,35$ mm. The width W_m of the wiper therefore falls within the scope of the invention.

The thickness of the beam 12 at the thickest point along the beam 12, T_m (expressed in millimetres) is 1.2 mm as shown in Figure 4. According to the second aspect of the invention the magnitude of the thickness at the thickest point along the beam 12, T_m (expressed in millimetres), where L is 600 mm and E is 200 GPa, should be less than $0.0007 * L - 0.0027407 * E + 1.37814 = 0.0007 * 600 - 0.0027407 * 200 + 1.37814 = 1,25$ mm. The thickness T_m of the wiper therefore also falls with the scope of the invention.